

FIG. 1

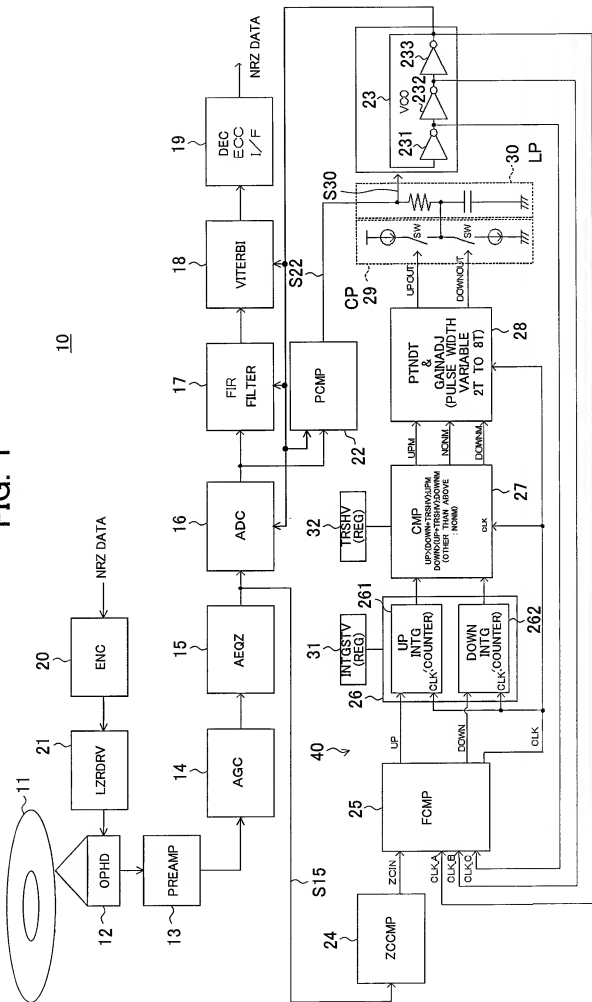




FIG. 3

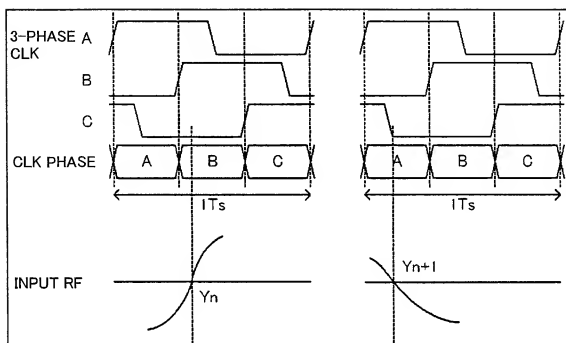


FIG. 4

## FREQUENCY COMPARATOR LOGIC

Y <sub>n</sub>	Y <sub>n+1</sub>	UP	DOWN
A	A	0	0
A	B	0	1
A	C	1	0
B	A	1	0
B	B	0	0
B	C	0	1
C	A	0	1
C	B	1	0
C	C	0	0

FIG. 5

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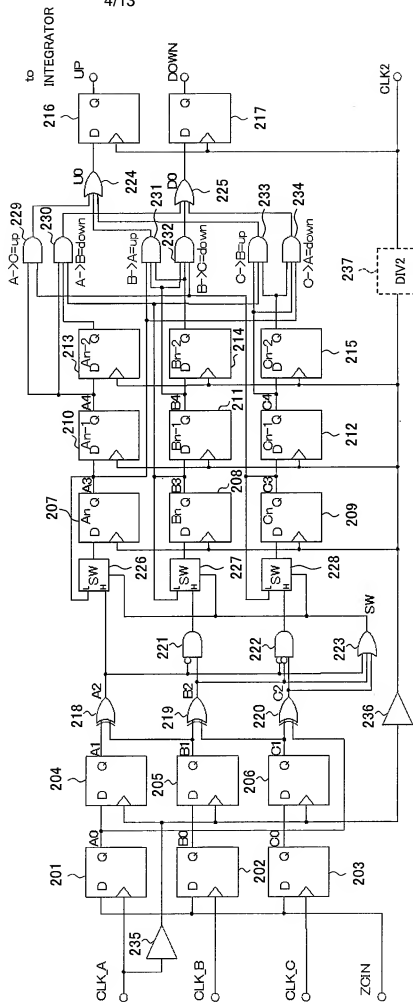


FIG. 6

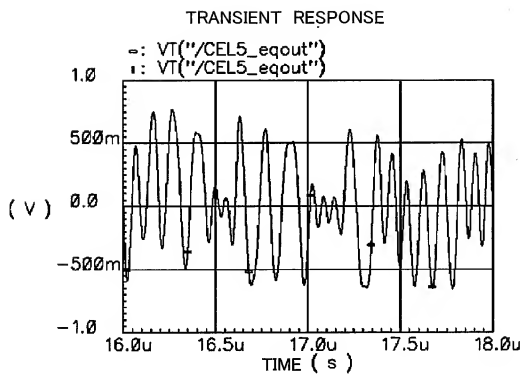


FIG. 7  
EXAMPLE OF ZERO CROSS DISTRIBUTION

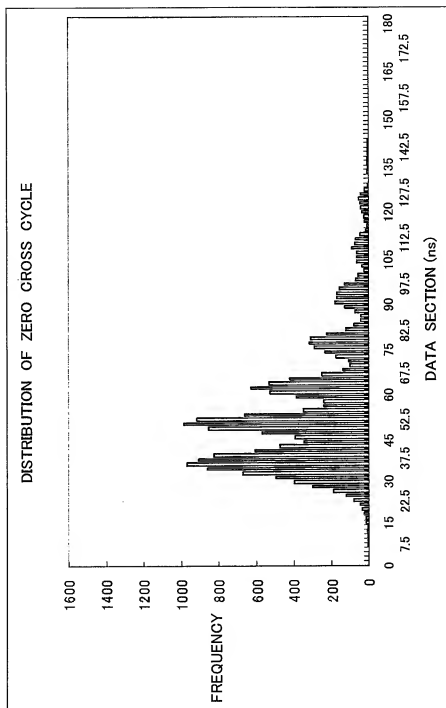
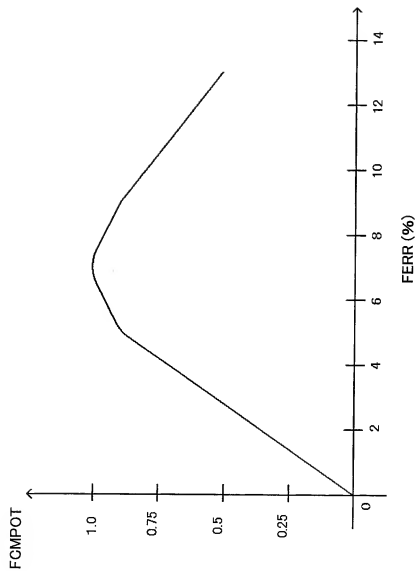


FIG. 8  
CASE OF BD ROM (THEORETICAL VALUE)



(CASE WHERE INTEGRATION SETTING VALUE = 8, JUDGEMENT THRESHOLD VALUE = 4, UPM IS OUTPUT)

FIG. 9A CLK

FIG. 9B UP

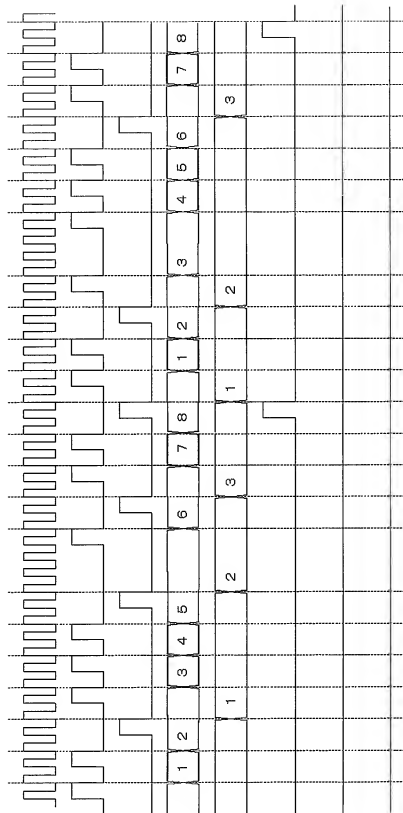
FIG. 9C DOWN

FIG. 9D UP  
COUNTERFIG. 9E DOWN  
COUNTER

FIG. 9F UPM

FIG. 9G DOWNM

FIG. 9H NONM





(CASE WHERE INTEGRATION SETTING VALUE = 8, JUDGEMENT THRESHOLD VALUE = 4, NONM IS OUTPUT)

FIG. 10A CLK

FIG. 10B UP

FIG. 10C DOWN

FIG. 10D UP  
COUNTER

FIG. 10E DOWN  
COUNTER

FIG. 10F UPM

FIG. 10G DOWNM

FIG. 10H NONM

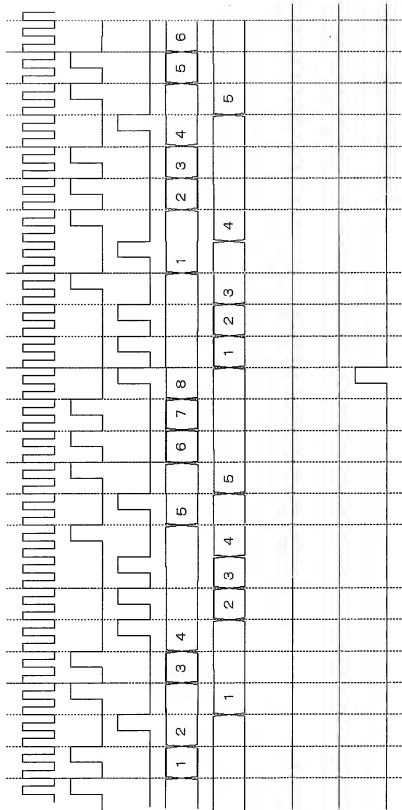


FIG. 11

THREE TIME PREVIOUS COMPARATOR OUTPUT	TWO TIME PREVIOUS COMPARATOR OUTPUT	ONE TIME PREVIOUS COMPARATOR OUTPUT	PRESENT COMPARATOR OUTPUT	OUTPUT	
				OUTPUT	GAIN (PULSE WIDTH)
OTHER THAN UPM	OTHER THAN UPM	OTHER THAN UPM	UPM	NONE	0
	EITHER IS UPM			UPOUT	0.25(1T)
OTHER THAN UPM	OTHER THAN UPM	UPOUT		0.25(1T)	
	UPM	UPM		0.5(2T)	
OTHER THAN DOWNM	OTHER THAN DOWNM	OTHER THAN DOWNM		UPOUT	1(4T)
	EITHER IS DOWNM			NONE	0
OTHER THAN DOWNM	OTHER THAN DOWNM	DOWNM		DOWNOUT	0.25(1T)
	DOWNM			DOWNOUT	0.25(1T)
ALL	ALL			DOWNOUT	0.5(2T)
	ALL			DOWNOUT	1(4T)
			NONM	NONE	0

## INITIAL OPERATION OF FREQUENCY LOCK-IN

FIG. 12A

UPM

FIG. 12B

DOWNM

FIG. 12C

NONM

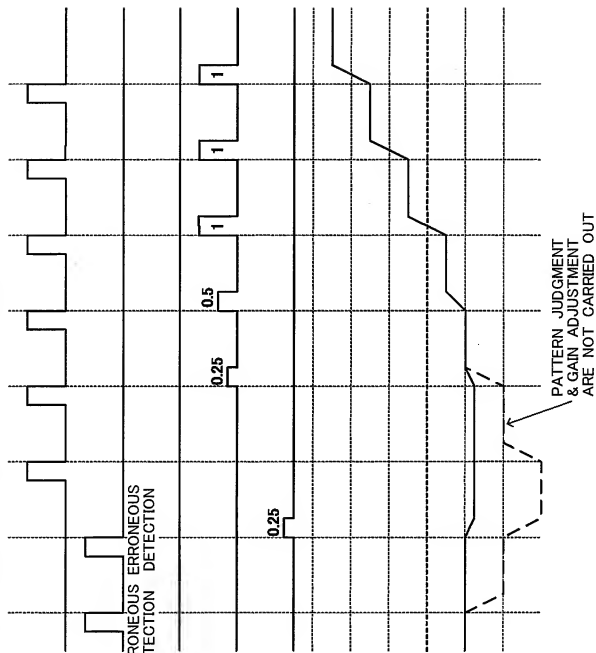
FIG. 12D

UPOUT  
GAIN

FIG. 12E

DOWNOUT  
GAIN

FIG. 12F

VCO  
CONTROL  
VOLTAGE

## OPERATION DURING FREQUENCY LOCK-IN

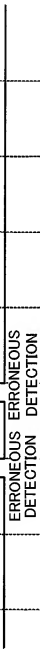
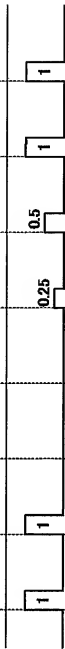
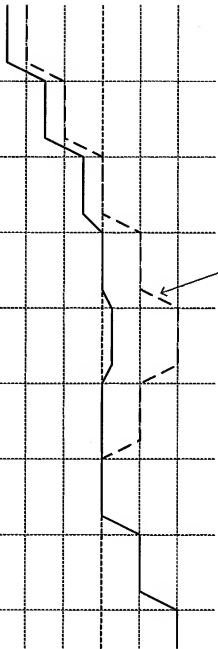
FIG. 13A UPM



FIG. 13B DOWNM



FIG. 13C NONM

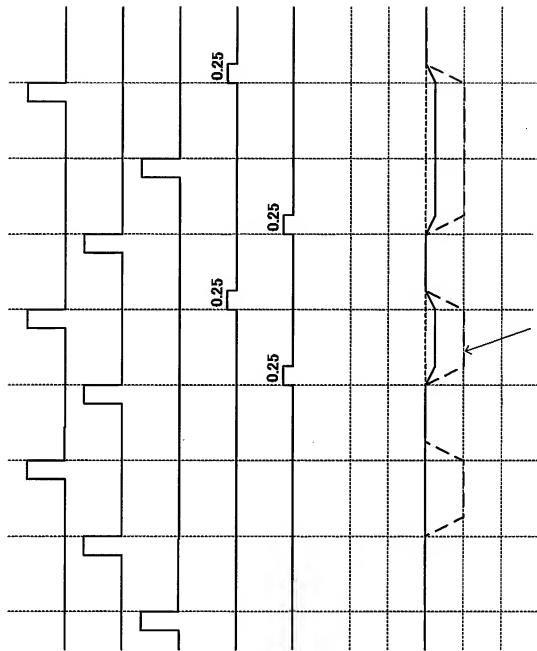
ERRONEOUS  
DETECTION  
ERRONEOUS  
DETECTIONFIG. 13D UPOUT  
GAINFIG. 13E DOWNOUT  
GAINFIG. 13F VCO  
CONTROL  
VOLTAGEPATTERN JUDGMENT  
& GAIN ADJUSTMENT  
ARE NOT CARRIED OUT

## OPERATION AT CONVERGENCE

FIG. 14A UPM

FIG. 14B DOWNM

FIG. 14C NONM

FIG. 14D UPOUT  
GAINFIG. 14E DOWNOUT  
GAINFIG. 14F VCO  
CONTROL  
VOLTAGE

PATTERN JUDGMENT  
& GAIN ADJUSTMENT  
ARE NOT CARRIED OUT